# GEOLOGICAL INVESTIGATION AND SLOPE RISK ASSESSMENT AT WINDERMERE, NORTHERN TASMANIA

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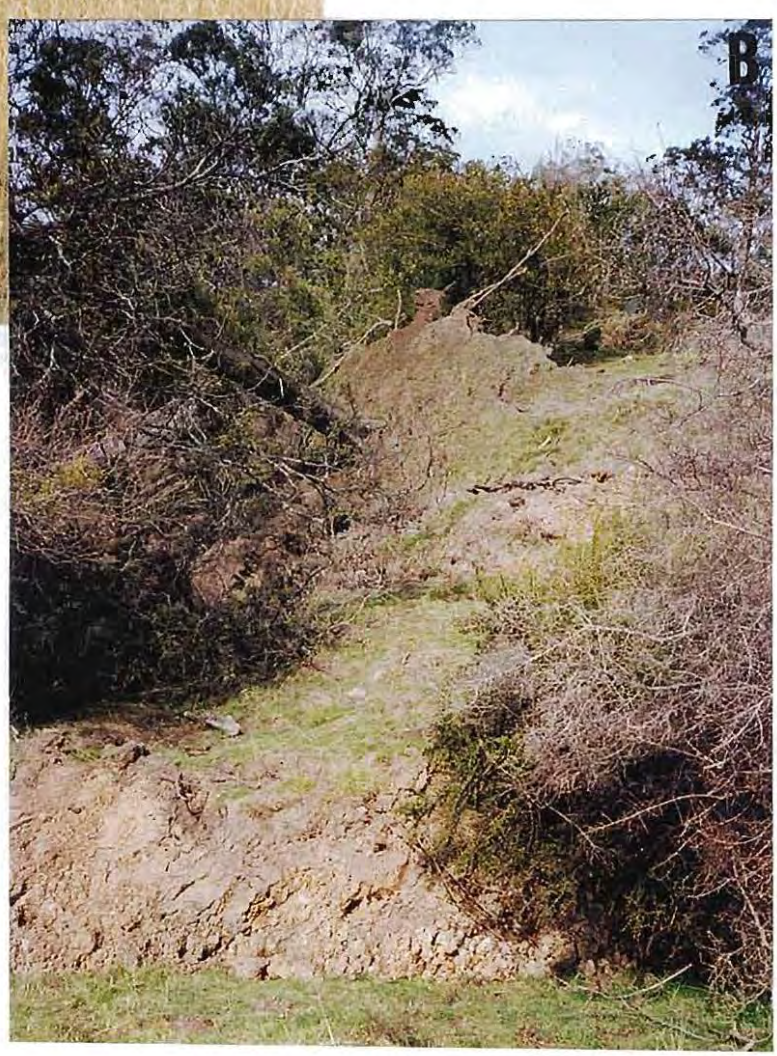
**Frontispiece:** Evidence for movement. Plate A was taken on the 11.2.98 and B 5 months later. Note, the fallen tree


A


B

# ABSTRACT

Land stability analysis is increasingly important in the Tamar Valley, northern Tasmania, due to the extension of urbanisation into steeply sloping areas, which afford the best panoramic views. The Windermere area of the Tamar Valley, the subject of this study, has a long history of slope failure because of its association with reactive and expansive clays. A combination of geological, morphological and hydrological factors influence slope failure, rather than a single factor. These factors are considered in this study in relation to areas of past movement, slope, geology, hydrology and vegetation, in order to construct a zonation map illustrating the potential risk for slope failure throughout the area. Geographic Information Systems (GIS) have been used to establish standards for potential risk.

Rock units within the area have been identified using magnetic and seismic geophysical methods. The geology comprises mainly non-marine Tertiary sediments, which are overlain by a younger basalt flow. The basalt capping has been shown to cover a smaller area than previously mapped. The surveys also supported the view that only one basalt flow occurs on Gaunts Hill, and a second possible flow is actually a large basalt block within a talus deposit, which originated from the basalt capping. Reliable identification of *in situ* versus allochthonous materials is important in land stability analysis. The geophysical discrimination of these lithologies at a subdivision scale suggests these methods should be part of standard stability analysis in the Tamar area.

A number of areas of active failure (>10m deep) exist within the field area and a substantial portion has been subject to past instability. In one section (Native Landslide) active failure is occurring despite a cover of natural vegetation, contrary to the view that vegetation prevents failure. Another area of active failure, Gaunts Landslide, covers an approximate area of 150m x 150m. The amount and direction of movement of Gaunts Landslide was measured using the grid method. The results illustrate that the slide is slumping rapidly - 4 metres down slope over a 5 month period (4 observations recorded). Clay samples from Gaunts Landslide were also analysed (XRD and shear box tests) to identify clay composition and sediment strength. The derived parameters from these analyses allowed slope stability analysis to be completed using Bishop's simplified method. The results indicate a highly unstable area and it is now believed that this slide cannot be stabilised. This is due to the failure plane being too deep, major drainage patterns running through the landslide, and irregular rainfall patterns.

Detailed topographical data was digitised from ortho-images, which combined with GIS analysis delineated the patterns of recent and past failure. The topographic data was processed to produce a flow accumulation model, which was used to identify a correlation between sites of active failure and elevated flow accumulation. Thus, the focussing of surface flow during rain events may be an important factor that enhances the chance of slope failure. The main factors that are important to slope failure are slope, drainage patterns, previous failure history, geology, degree of weathering, and to some degree vegetation. The current landslip zonations only take slope and geology into consideration.

Further revision of the current landslip zonation scheme should include factors such as hydrology, and vegetation, but most importantly, the potential reaction of clay minerals present in the sediments. It is not sufficient to simply classify some rocks as soft; pure clay has a critical angle of 5°, which is less than the present cut off of 7°. The current classification is based only on slope angles and is not a wholly representative or reliable appraisal of the related factors. This study suggests factor weighting proportions of 0.5 - areas of past movement, 0.2 - slope, 0.15 - geology, 0.1 - flow accumulation and 0.05 - to vegetation. These parameters are only characteristic of the Windermere area, and must be adapted to individual areas of study.

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